研究論文

# 高速信号伝送に及ぼす IC パッケージ基板における導体表面粗度の影響

†赤星知幸*,**，香西博明**，渡邊充広**

# Effect of Conductor Surface Roughness of IC Package Substrate on High-speed Signal Transmission

by

†Tomoyuki AKAHOSHI*,**, Hiroaki KOUZAI** and Mitsuhiro WATANABE**

(Received Jul. 19, 2018; Accepted Oct. 4, 2018)

**Abstract**

In the high-speed signal transmission, it is known that the influence of the conductor surface roughness on the signal trace in IC package substrate becomes serious. In this paper, we focus two boundary surfaces, one is from an insulation layer to a conductor layer, and the other is from a conductor layer to an insulation layer. Since these surfaces are made in different processes, it is necessary to clarify an effect in each process. By measurement and simulation results, we found that lower conductor surface roughness is more effective than the insulation layer, and we also found that the effect becomes larger as the signal speed increases.

***Keywords:*** IC Package Substrate, High-speed Signal, Conductor Surface, S-parameter

## 1. 緒言

半導体製品のパッケージ形態の一つである FCBGA (Flip Chip Ball Grid Array)は，Fig. 1 に示すように，IC チップはパッケージ基板（IC Package Substrate, PKG）に搭載された後，マザーボード（Printed Circuit Board, PCB）に実装される [1)-3)]．ここで，IC チップを入出力する信号は，PKG 内および PCB 内の信号配線を伝送する．高速信号は，良好な伝送品質を保つため，Fig. 2 に示すように，信号層の上下にグランド層でシールドしたストリップライン構造を用いるのが一般的である [4),5)]．その中で，PKG 内の信号層は配線密度を優先して薄く細い信号配線で設計され，PCB 内の信号層は剛性を優先して厚く幅広い信号配線で設計される．

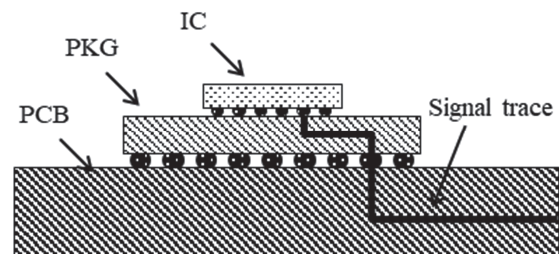


Fig. 1 Cross section of FCBGA package structure.

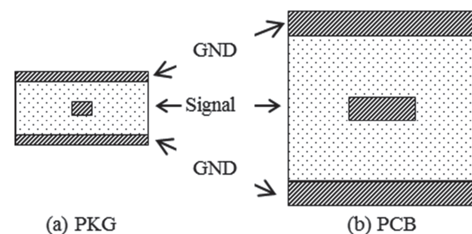


Fig. 2 Strip line structures in PKG and PCB cross sections.

平成 30 年 7 月 19 日受付

* 株式会社富士通研究所：神奈川県厚木市森の里若宮 10-1
Devices & Material Laboratory, Fujitsu Laboratories Ltd. : 10-1 Morinosato-Wakamiya, Atsugi, Kanagawa, 243-0197, Japan

** 関東学院大学大学院工学研究科総合工学専攻：神奈川県小田原市荻窪 1162－2
Materials Research Laboratory, Kanto Gakuin Univ. : 1162-2 Ogikubo, Odawara, Kanagawa 250-0042, Japan

†:連絡先/Corresponding author